

Climate Change in the Prairies: An Assessment of Impacts and Adaptation

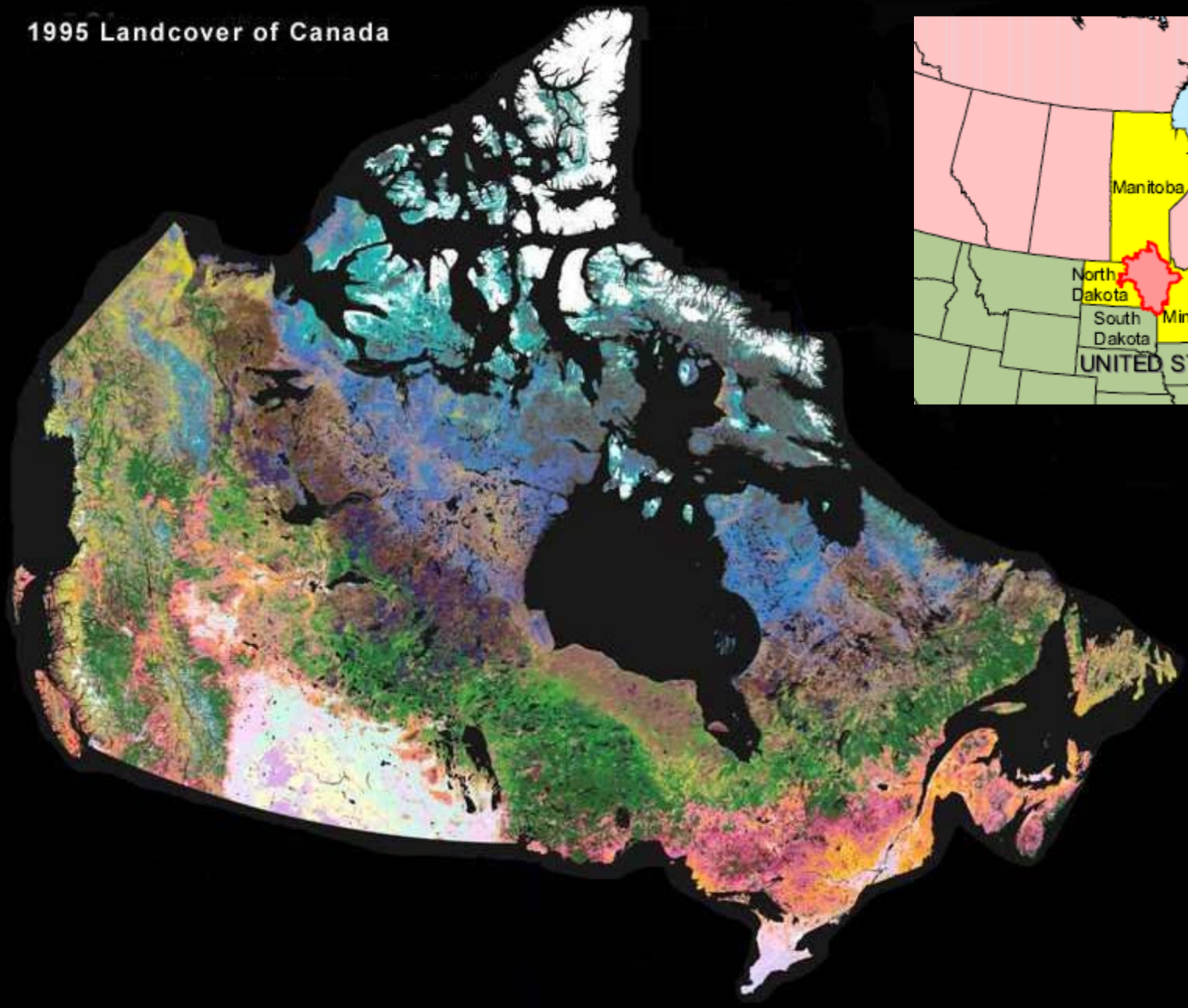
Dave Sauchyn, Prairie Adaptation Research Collaborative, University of Regina



<http://gsc.nrcan.gc.ca/floods/redriver/images/>

Shaping the Basin's Future Together, The Red River Basin Commission
January 20-22, Winnipeg

1995 Landcover of Canada



CHAPTER 7

Prairies



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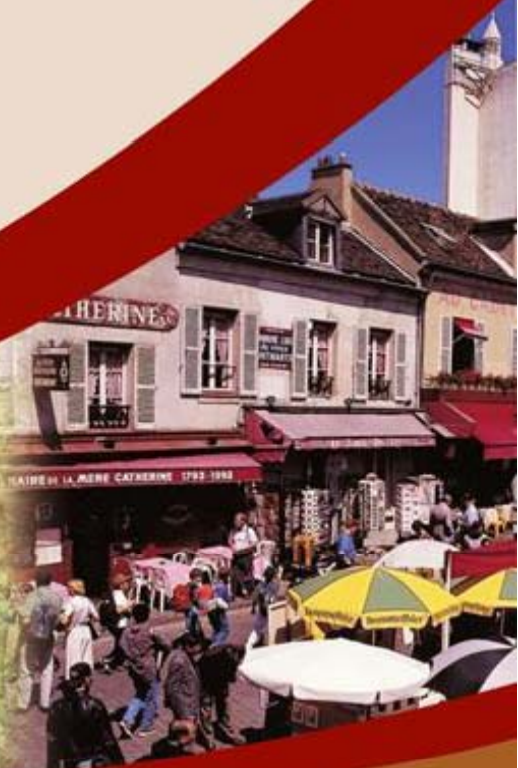
Contributing authors:

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Canada in a Changing Climate 2007

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The Assessment Report

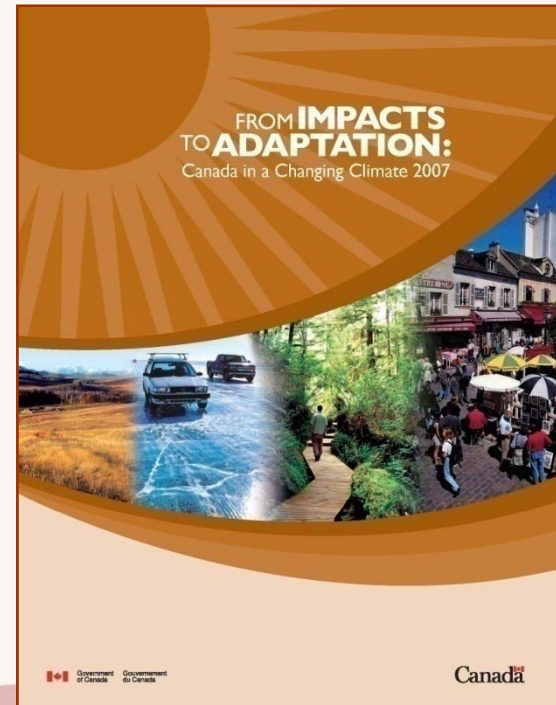
FROM IMPACTS
to ADAPTATION
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LES CHANGEMENTS
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First national-scale assessment of climate change impacts and adaptation in Canada since the Canada Country Study (1997)

GOALS

- Highlight advances made in understanding Canada's vulnerability to climate change in past decade
- Provide a knowledge foundation that informs adaptation decision-making and policy development in a non-prescriptive manner



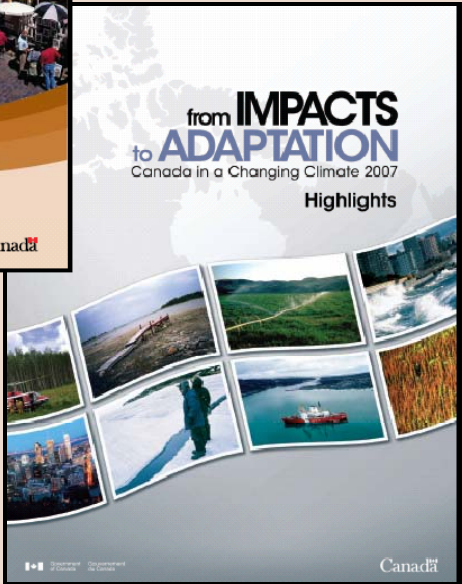
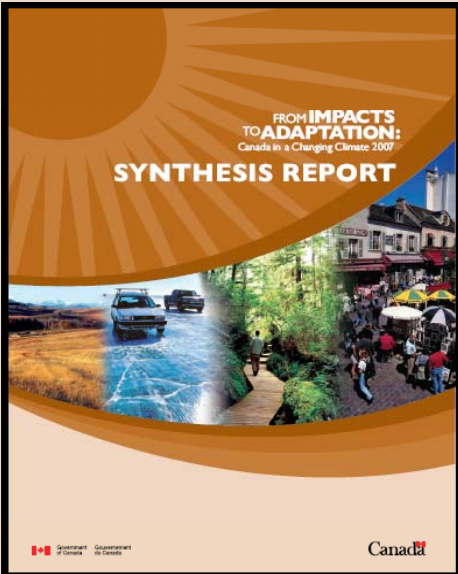
A robust, scientific process with many partners:

- The process was overseen by an advisory committee with representation from governments, academia, Aboriginal groups and the private sector.
- 145 authors from governments, universities and NGOs from across Canada participated, and over 3100 references were cited.
- Chapters were reviewed by 110 scientific experts and government (Federal, Provincial/Territorial) officials.



FROM **IMPACTS**
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Synthesis Report and Highlights



MORE INFORMATION

FROM IMPACTS
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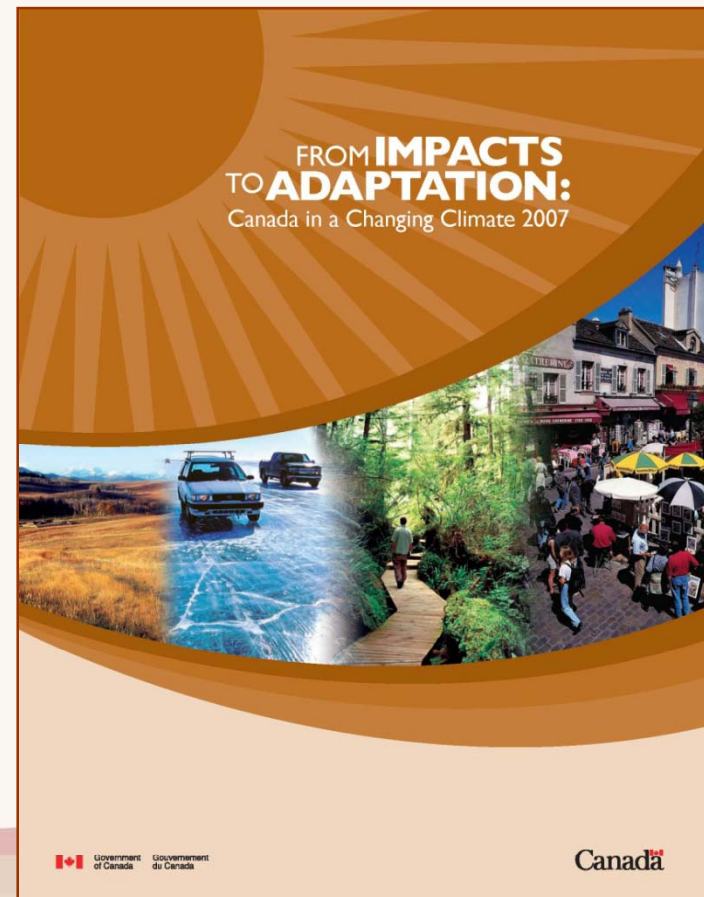
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Available on-line on March 7:

<http://adaptation2007.nrcan.gc.ca>

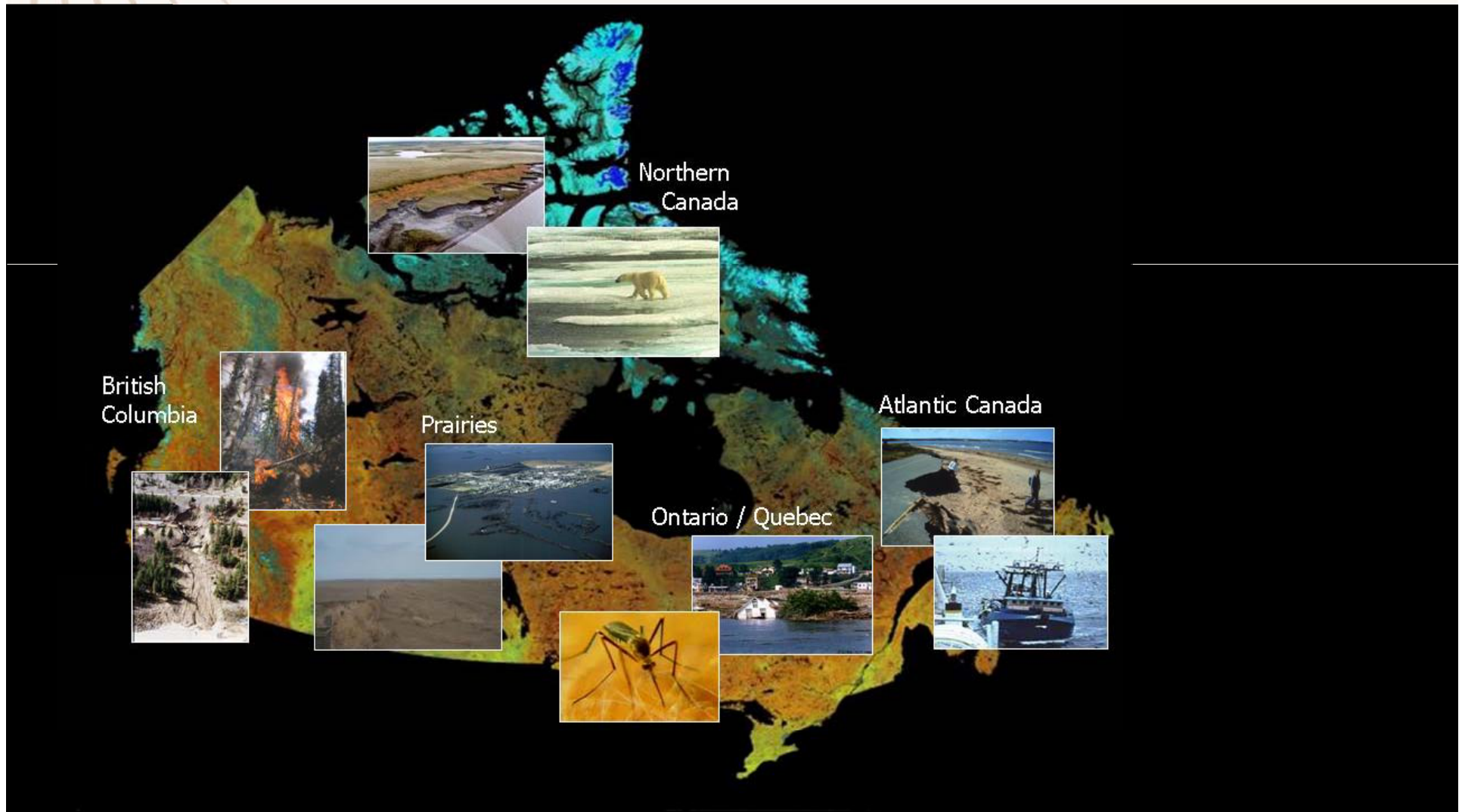
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Conclusions: impacts

Impacts of greatest concern vary between regions





The Prairie Adaptation Research Collaborative is a partnership of the governments of Canada, Alberta, Saskatchewan and Manitoba mandated to pursue climate change impacts and adaptation research in the Prairie Provinces.



Chapter 7: Prairies

1 INTRODUCTION

1.1 Description of the Prairies Region

1.2 Environment and Economy by Ecozone

2 REGIONAL CLIMATE AND SOCIOECONOMIC CHARACTERISTICS

2.1 Demographics

2.2 Economic Activities and Employment

2.3 Economic and Social Trends and Projections

2.4 Past Climate

2.5 Scenarios of Future Climate

3 SENSITIVITIES AND KEY VULNERABILITIES: NATURAL CAPITAL

3.1 Water Resources

3.2 Ecosystems

3.3 Soil Landscapes

4 RISKS AND OPPORTUNITIES: SOCIOECONOMIC SECTORS

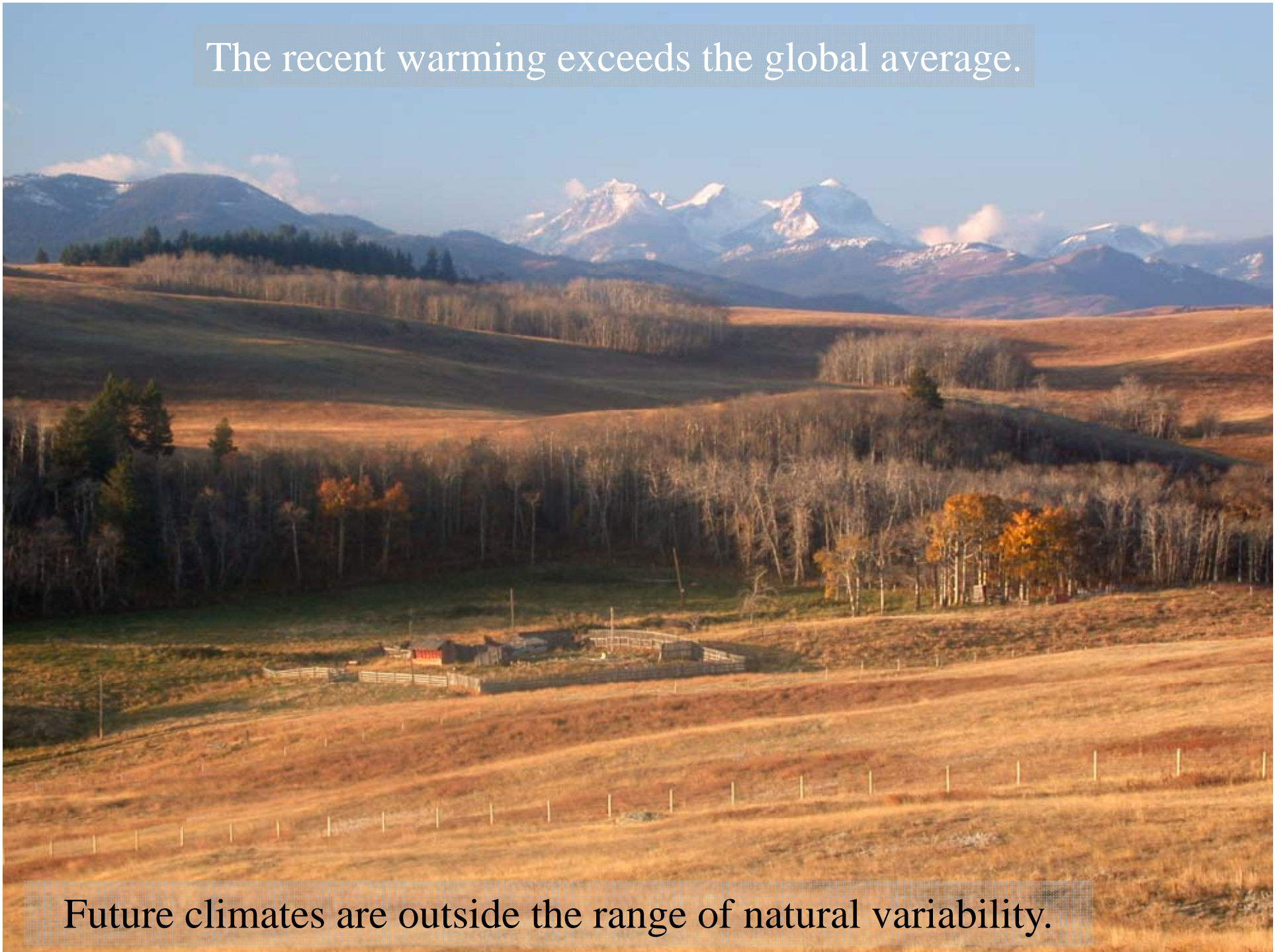
- 4.1 Agriculture
- 4.2 Forestry
- 4.3 Transportation
- 4.4 Communities
- 4.5 Health
- 4.6 Energy
- 4.7 Tourism and Recreation

5 ADAPTATION AND ADAPTIVE CAPACITY

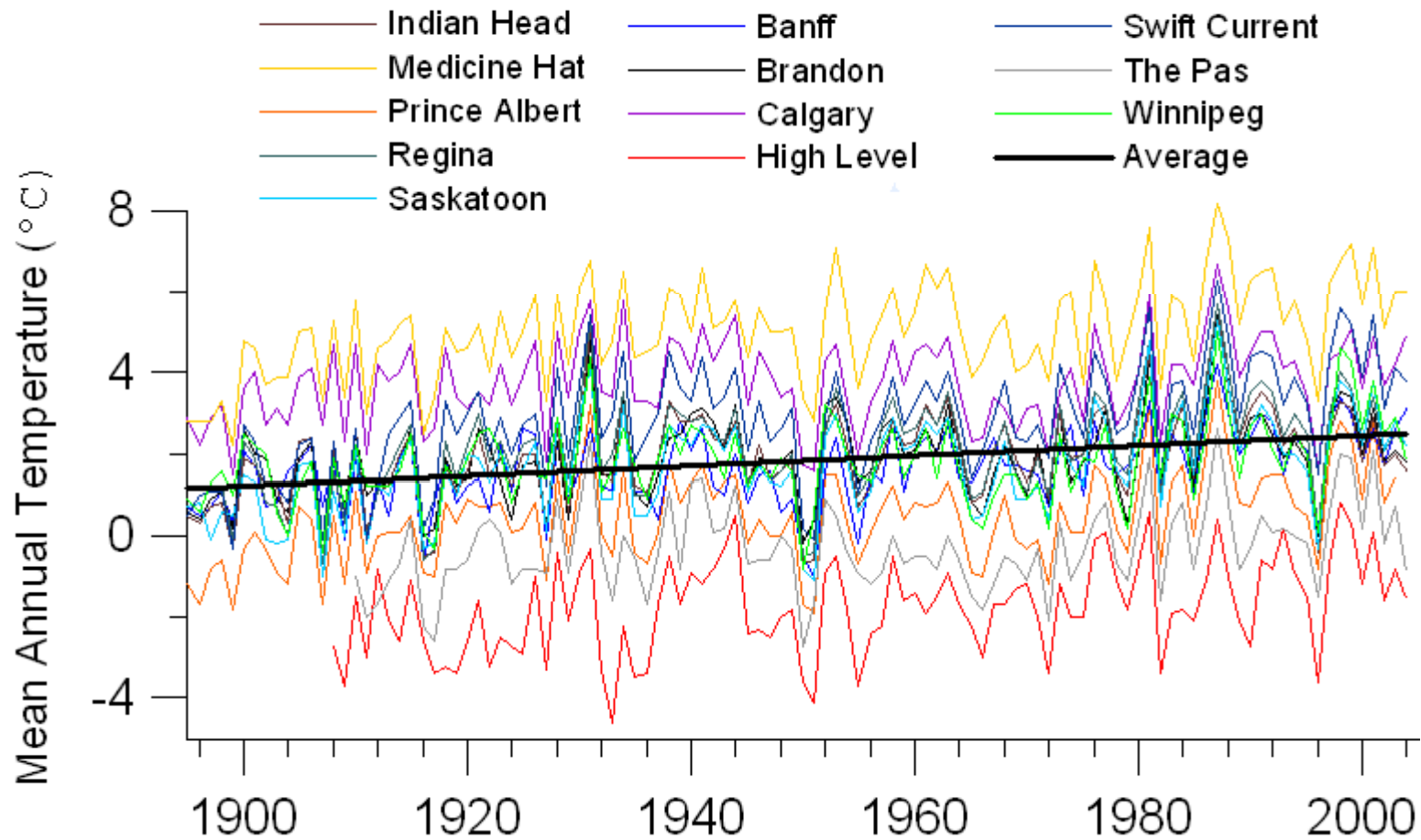
- 5.1 Formal Institutions and Governance
 - 5.1.1 Water Resource Management
 - 5.1.2 Ecosystem Management
 - 5.1.3 Agriculture
 - 5.1.4 Forestry
 - 5.1.5 Health and Well-Being
- 5.2 Local Adaptation, Informal Institutions and Social Capital

6 SYNTHESIS

The recent warming exceeds the global average.

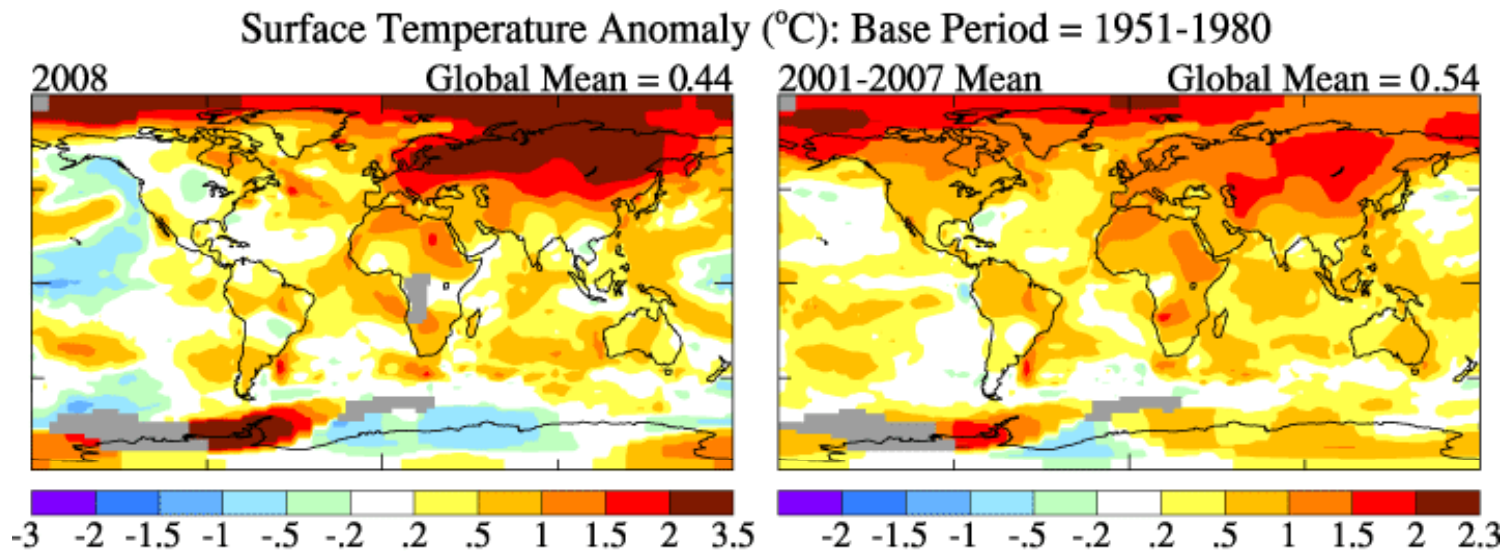
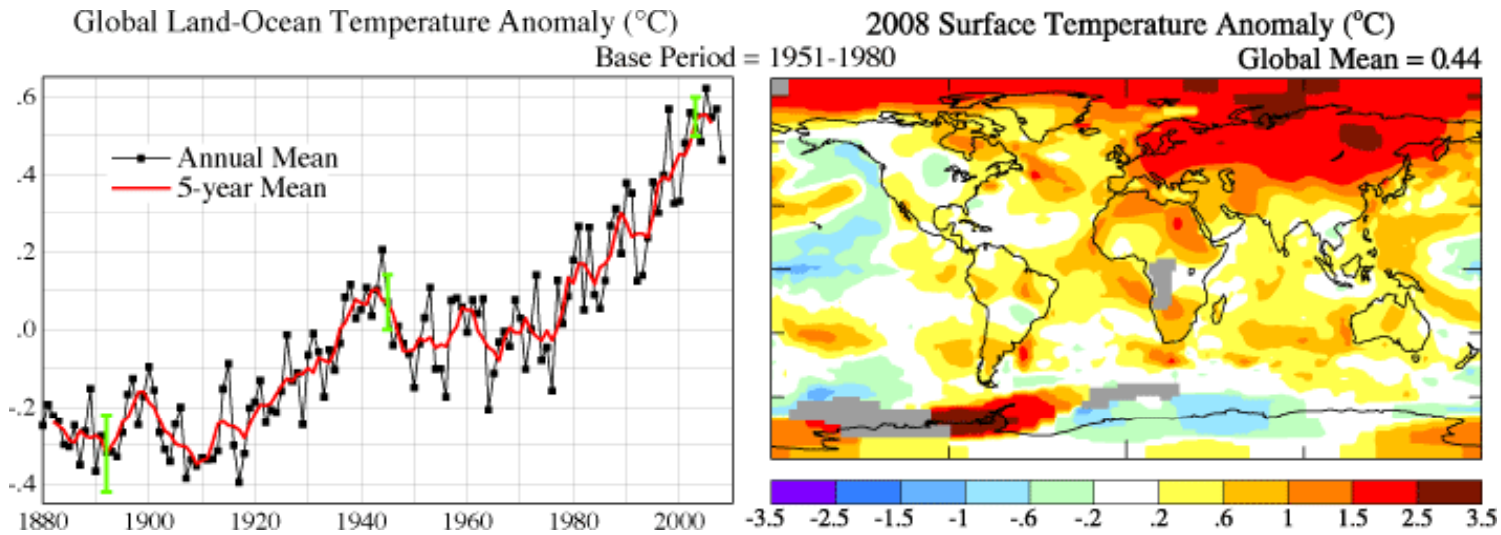


Future climates are outside the range of natural variability.



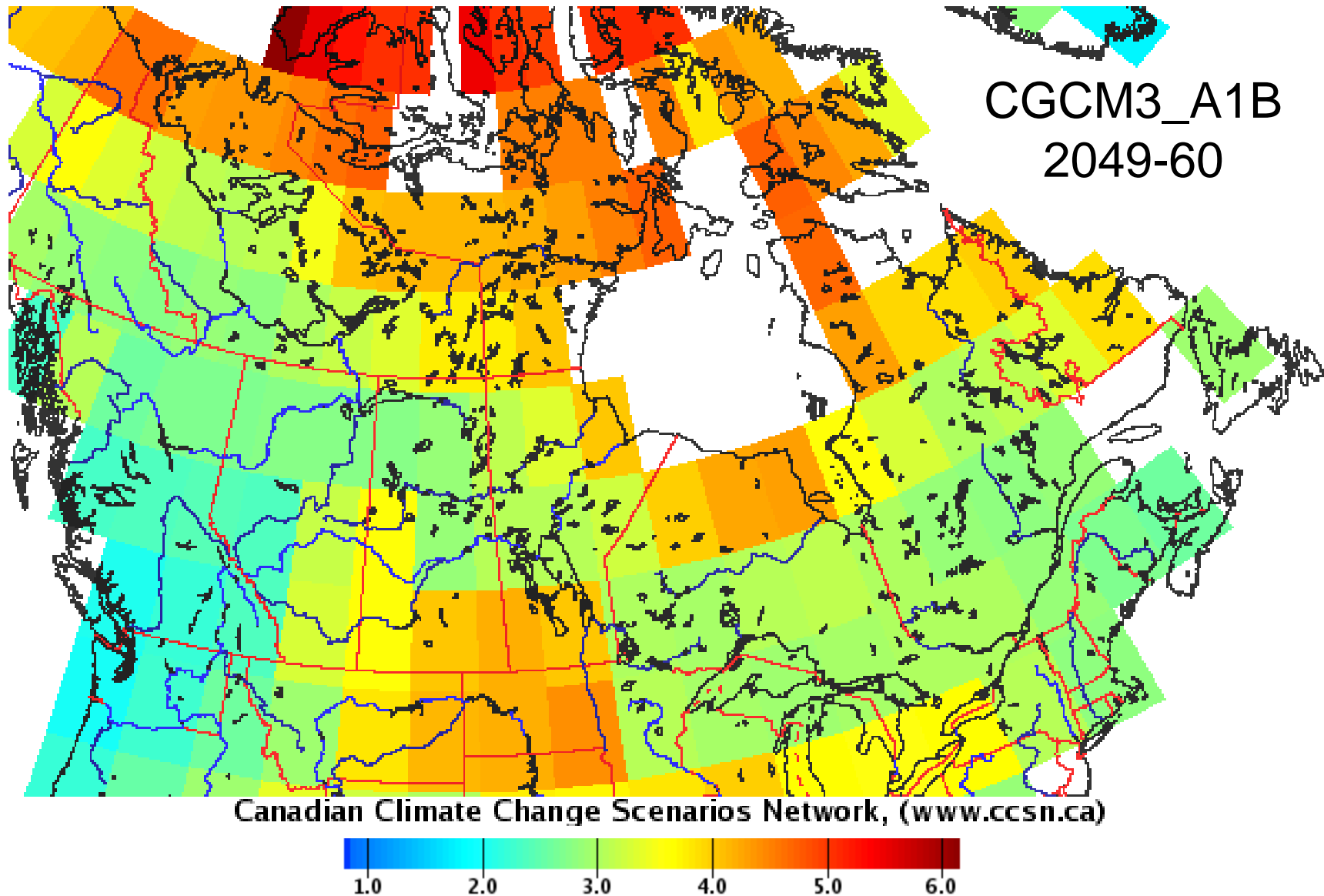
Trends in mean annual temperature since 1895 for 12 climate stations spread across the Prairies. The average increase in mean annual temperature for the 12 stations is 1.6°C.

Global Temperatures: Departures from 1951-80

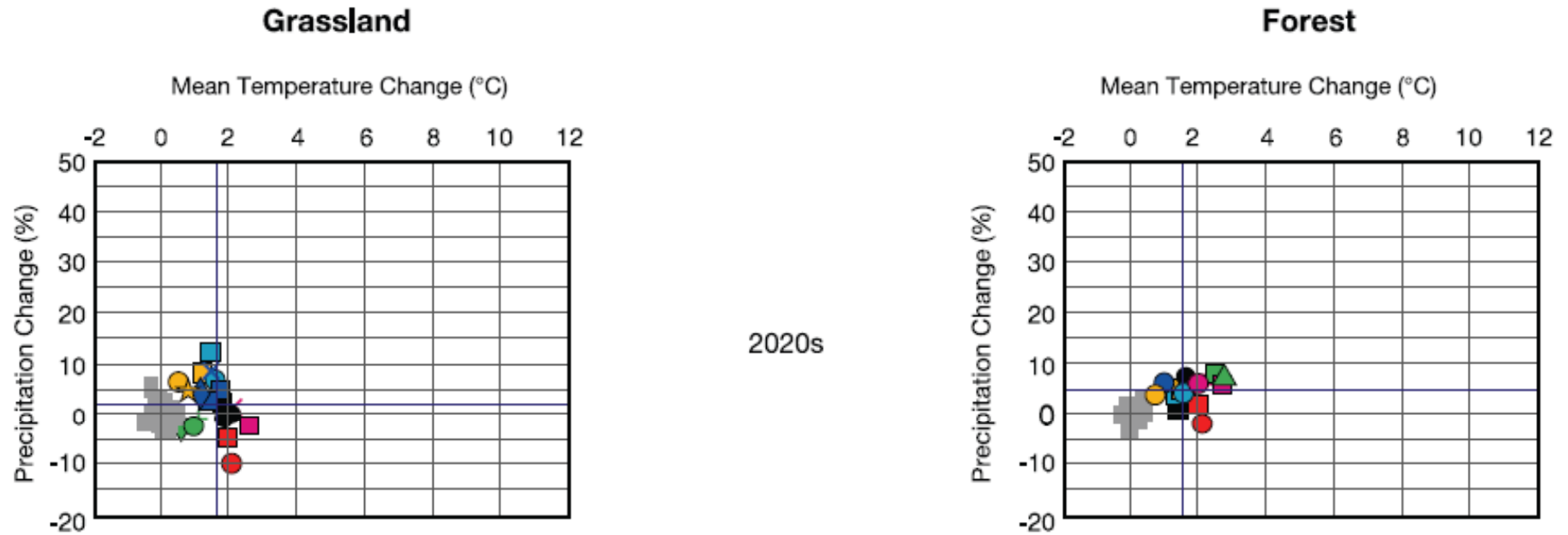


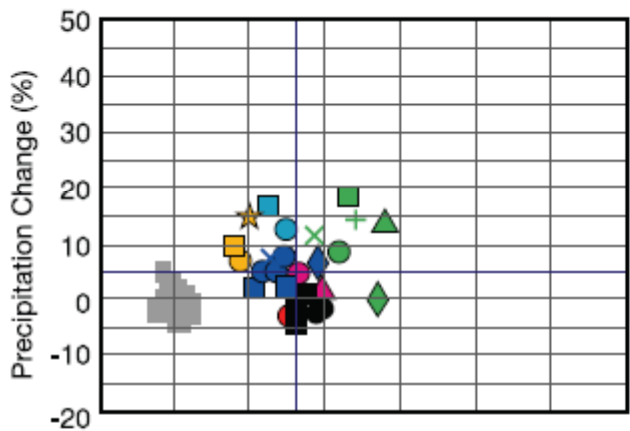
<http://data.giss.nasa.gov/gistemp/>

Mean Annual Temperature ($^{\circ}$ C) 2049-60 versus 1961-90

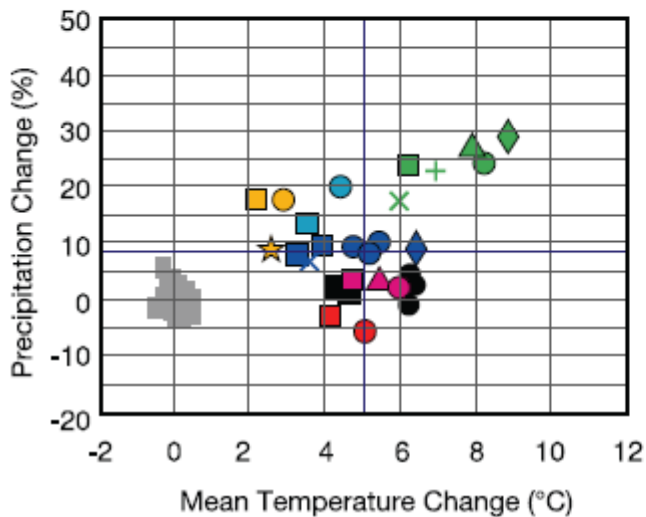
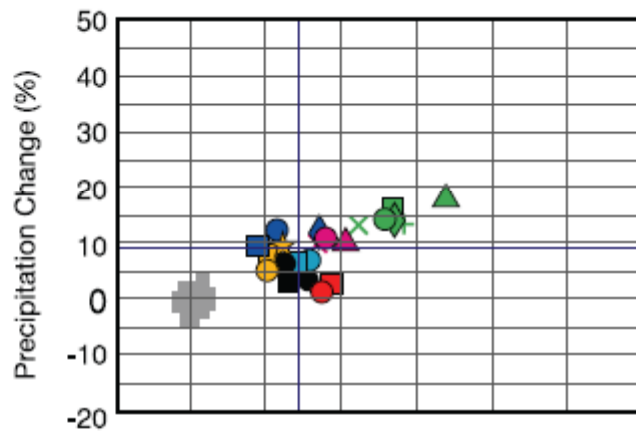


Projected changes in mean seasonal temperature and precipitation for the grassland and forest regions of the Prairie Provinces. The grey squares indicate the 'natural' climate variability simulated by a long control run of the CGCM2.

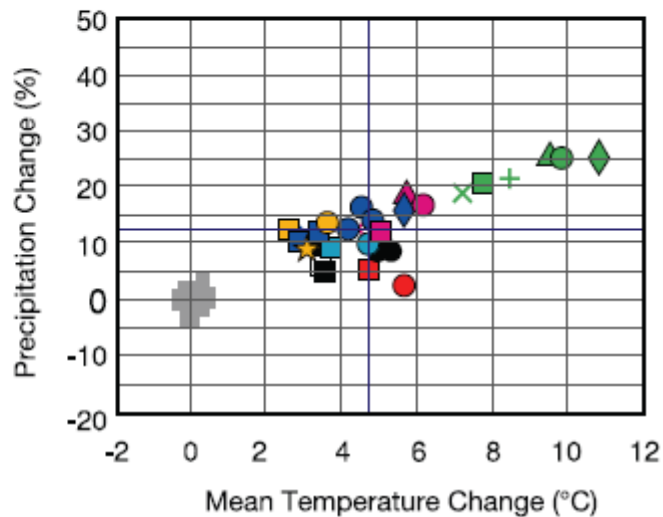




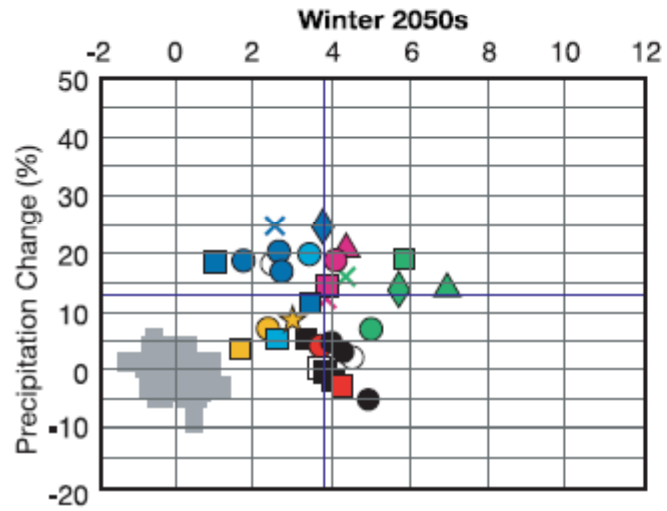
2050s



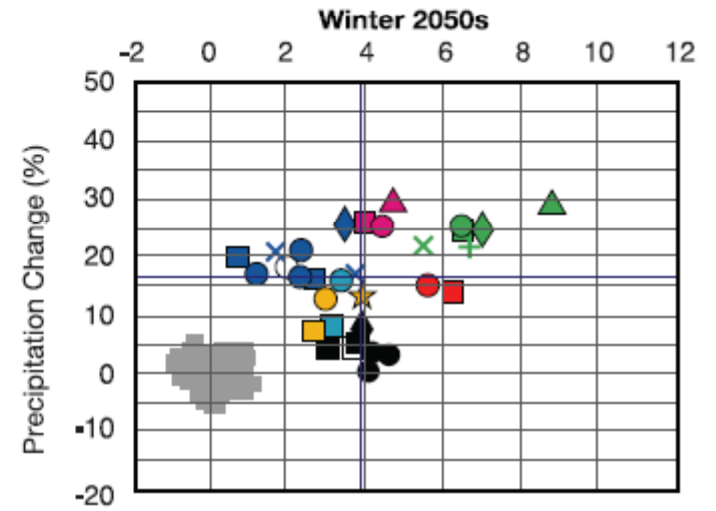
2080s



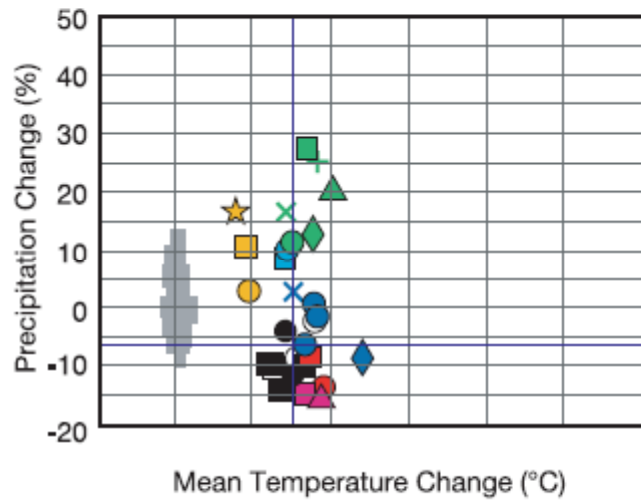
Grassland



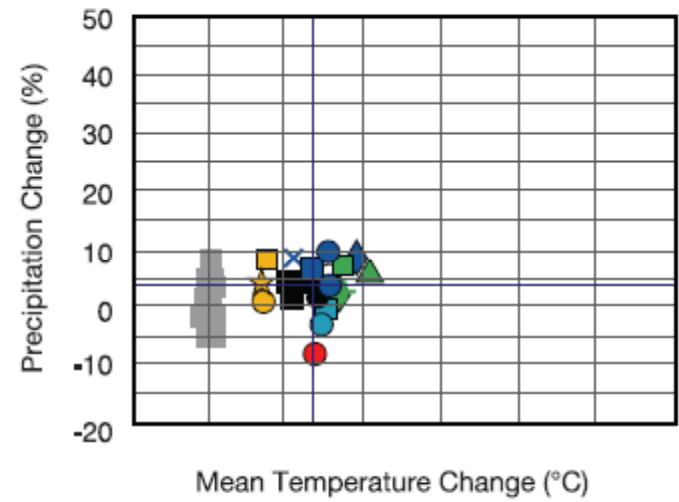
Forest



Summer 2050s



Summer 2050s



We are losing the advantage of a cold winter



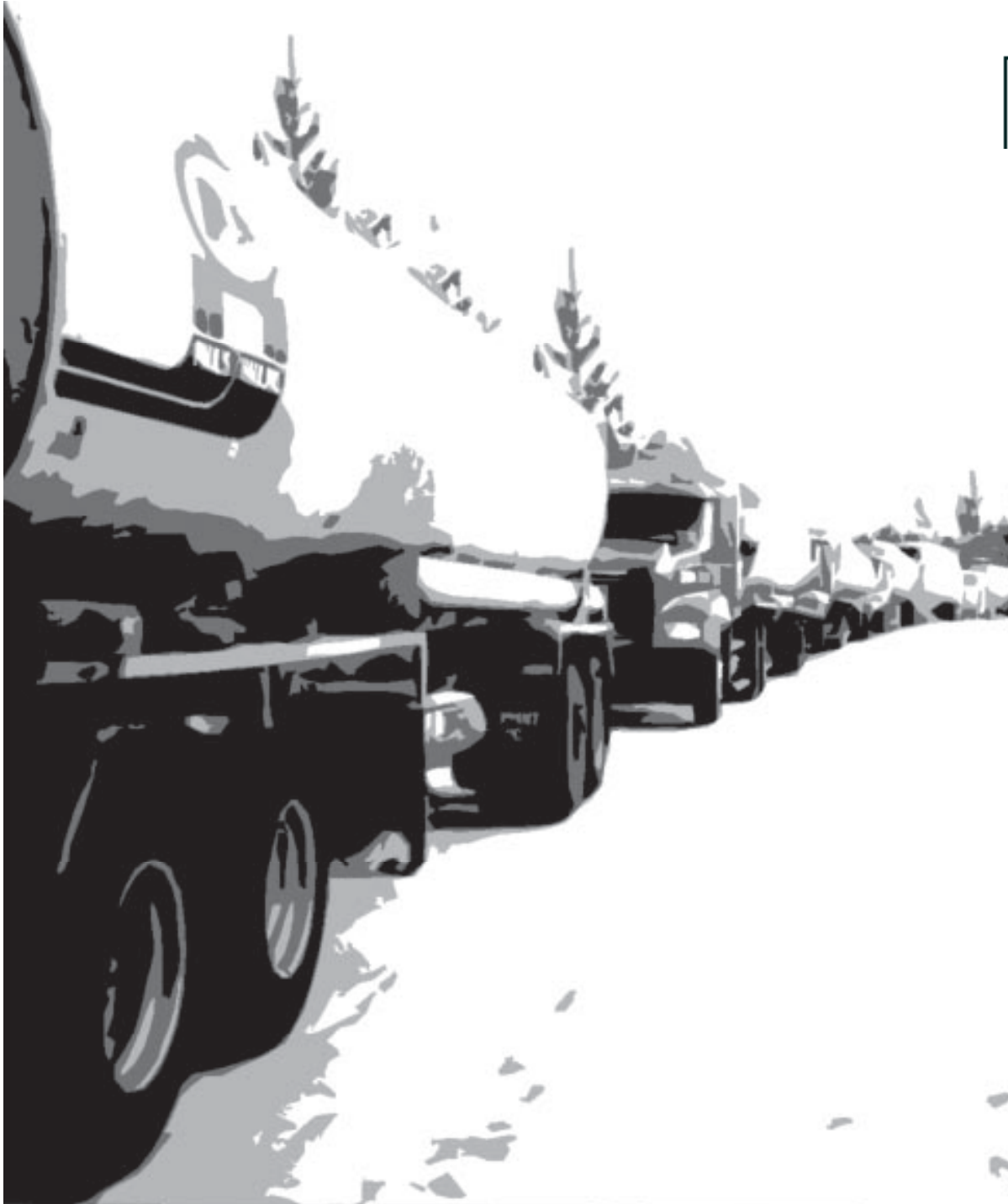
The longer ice-free season in Hudson Bay will increase opportunities for ocean-going vessels to use the Port of Churchill.



But northern railways, such as the rail line serving Churchill, will require more frequent repair, if not replacement.

CASE STUDY 4

Winter Roads in Northern Manitoba



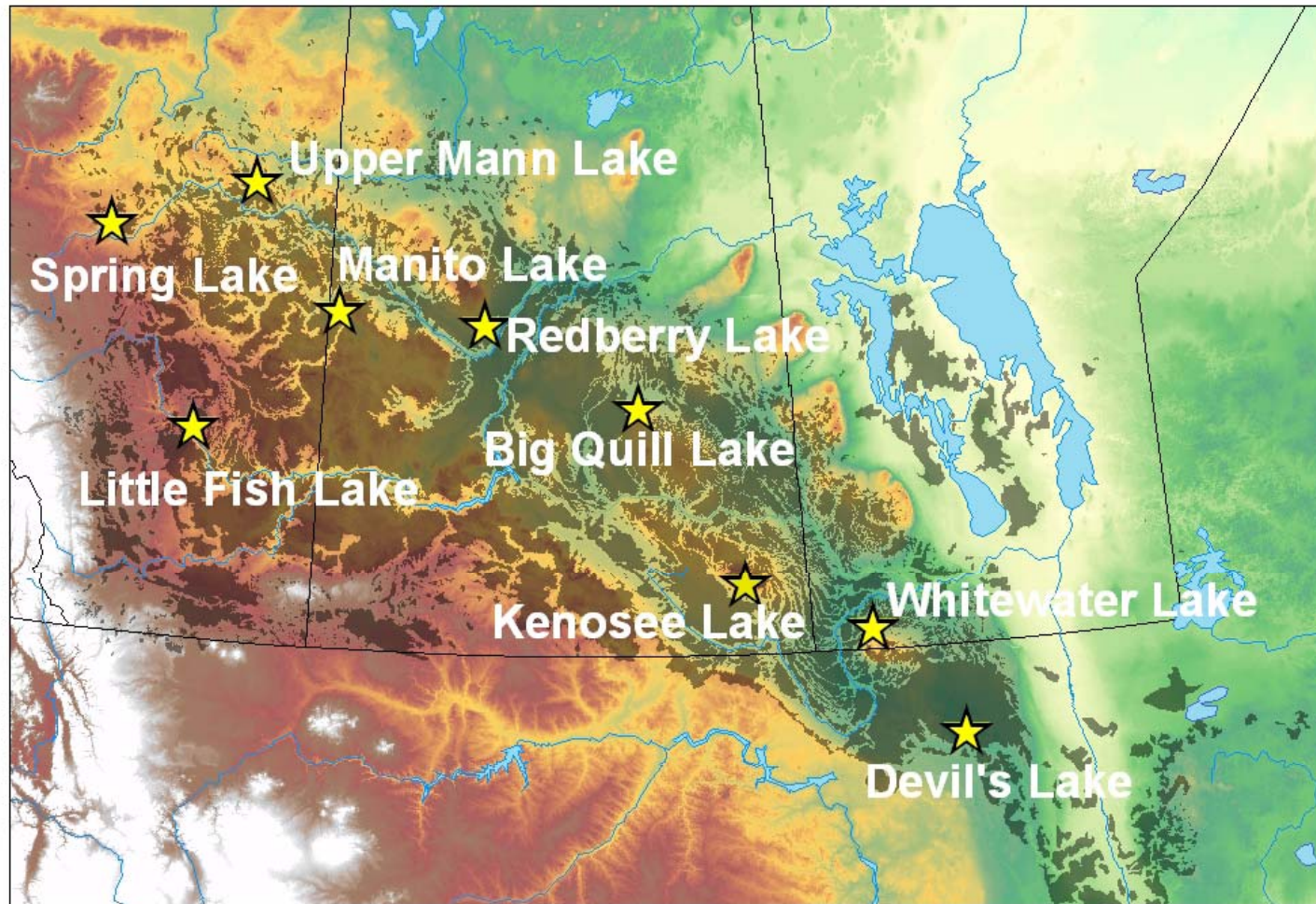
The average length of the winter road season in Manitoba is expected to decrease by 8 days in the 2020s, 15 days in the 2050s and 21 days in the 2080s

One of the most certain projections is that extra water will be available in winter and spring, while summers generally will be drier



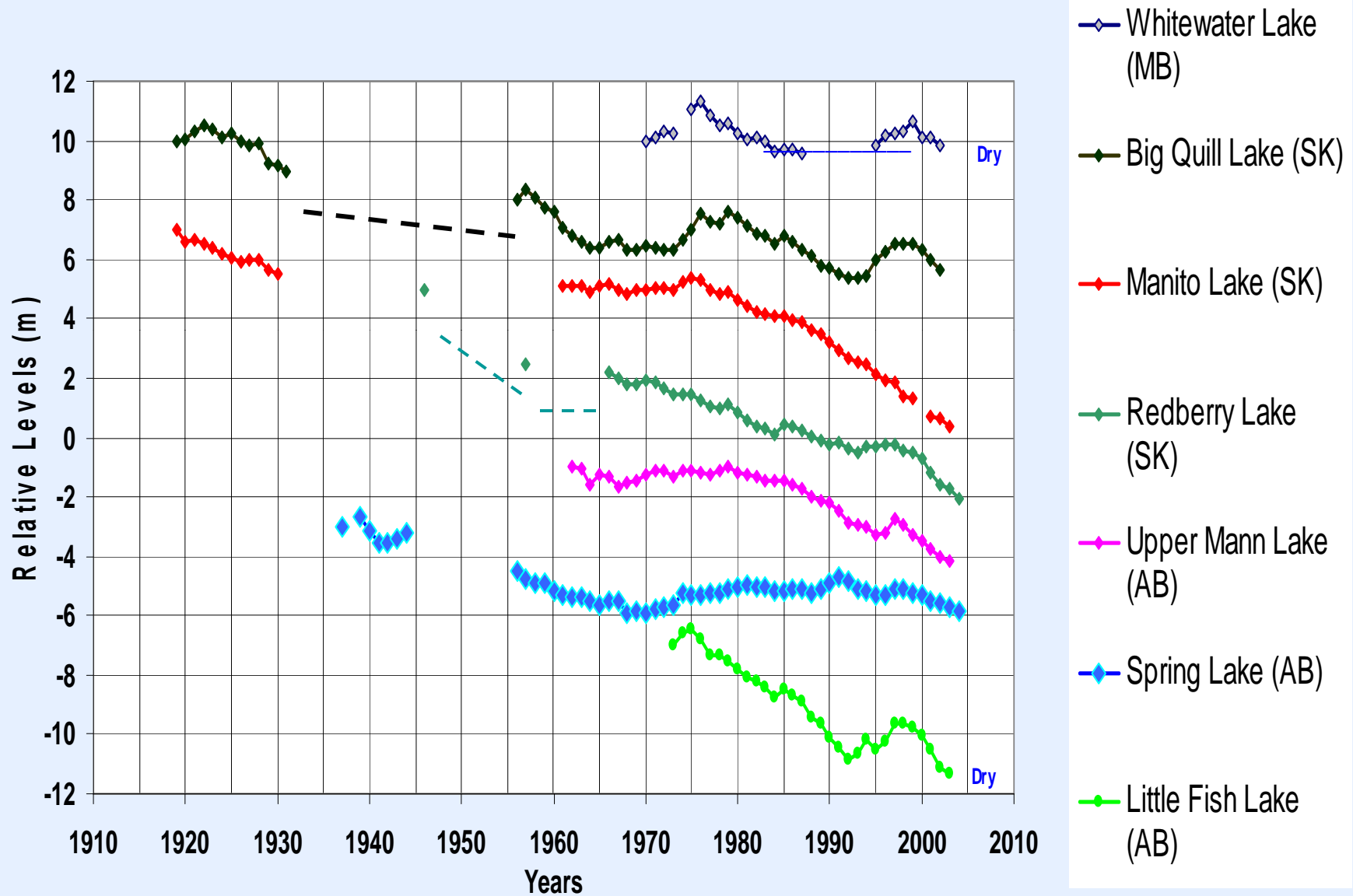
On average, there will be slightly to significantly less surface and soil water

Closed-basin Prairie Lakes

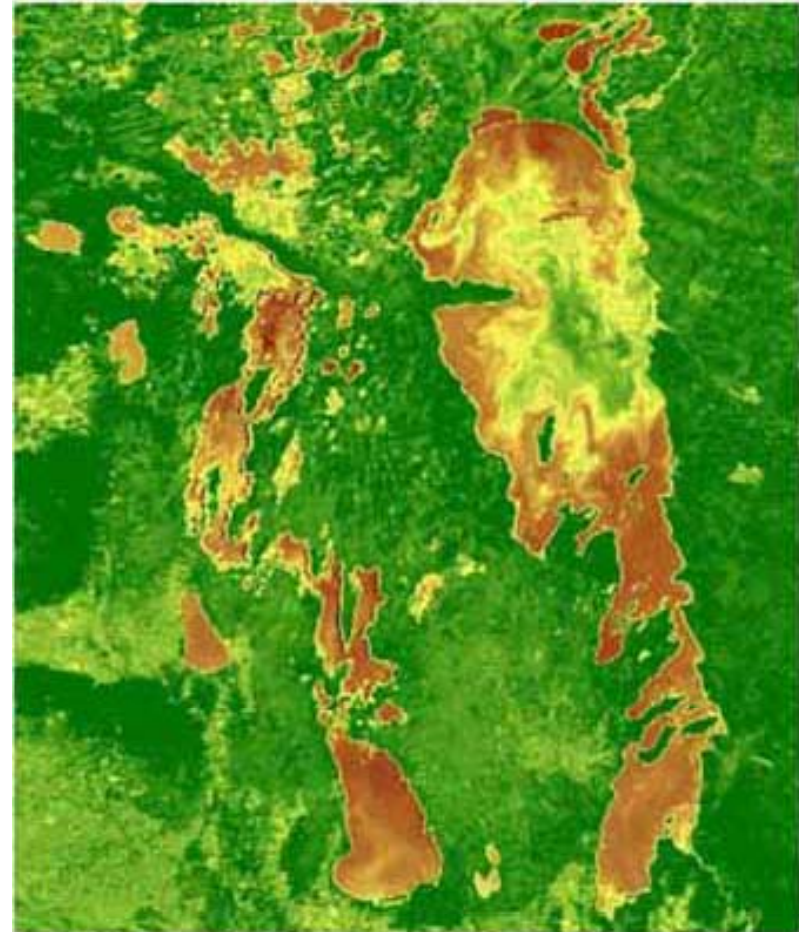
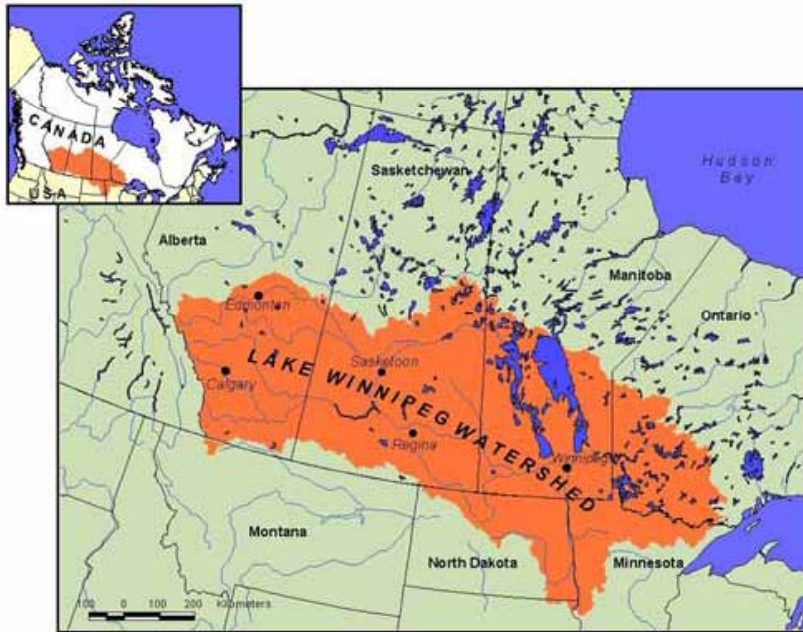


van der Kamp *et al.*, CWRJ, 2008

Closed-basin lake level changes, 1918-2004 (van der Kamp *et al.*)

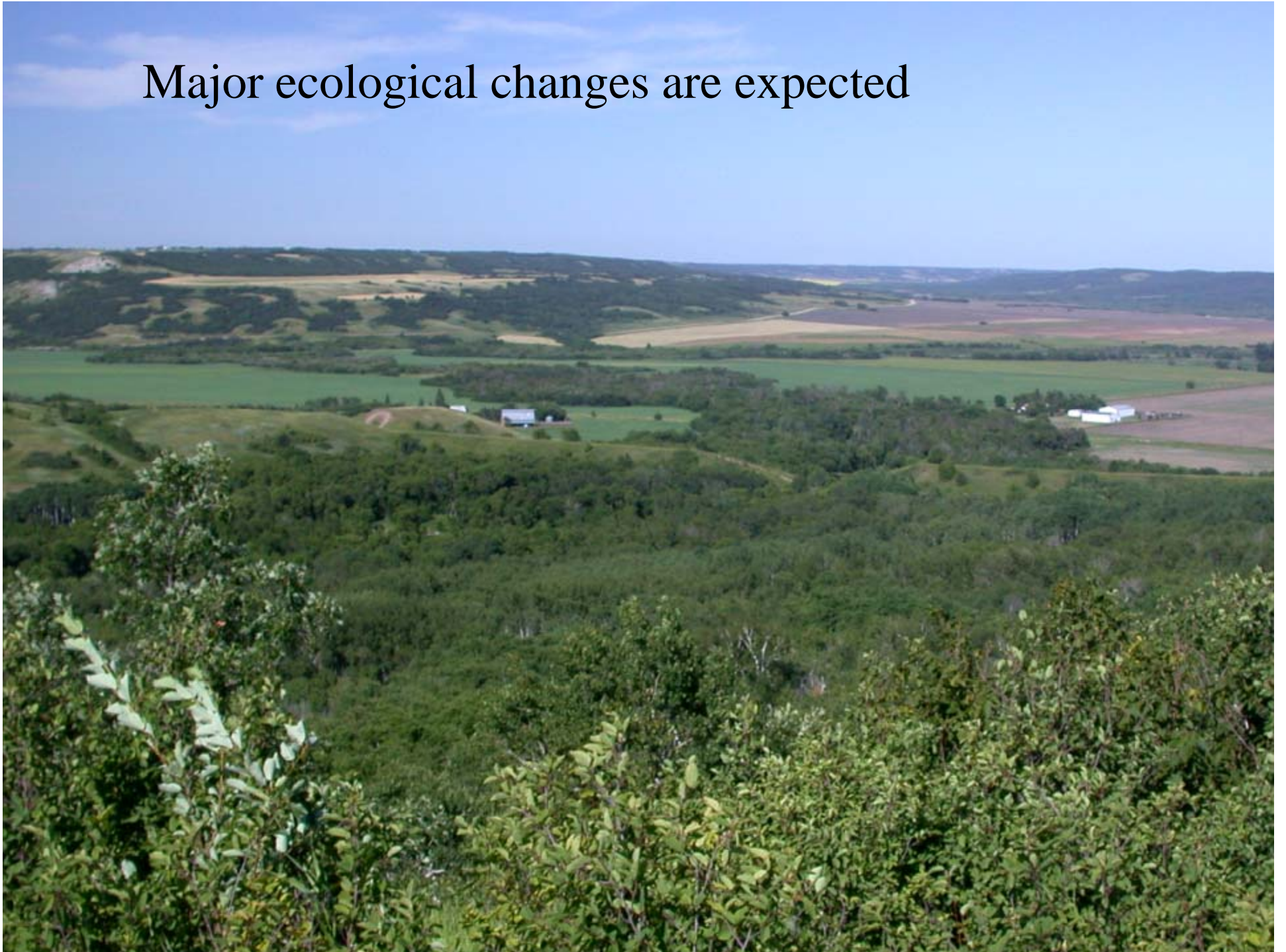


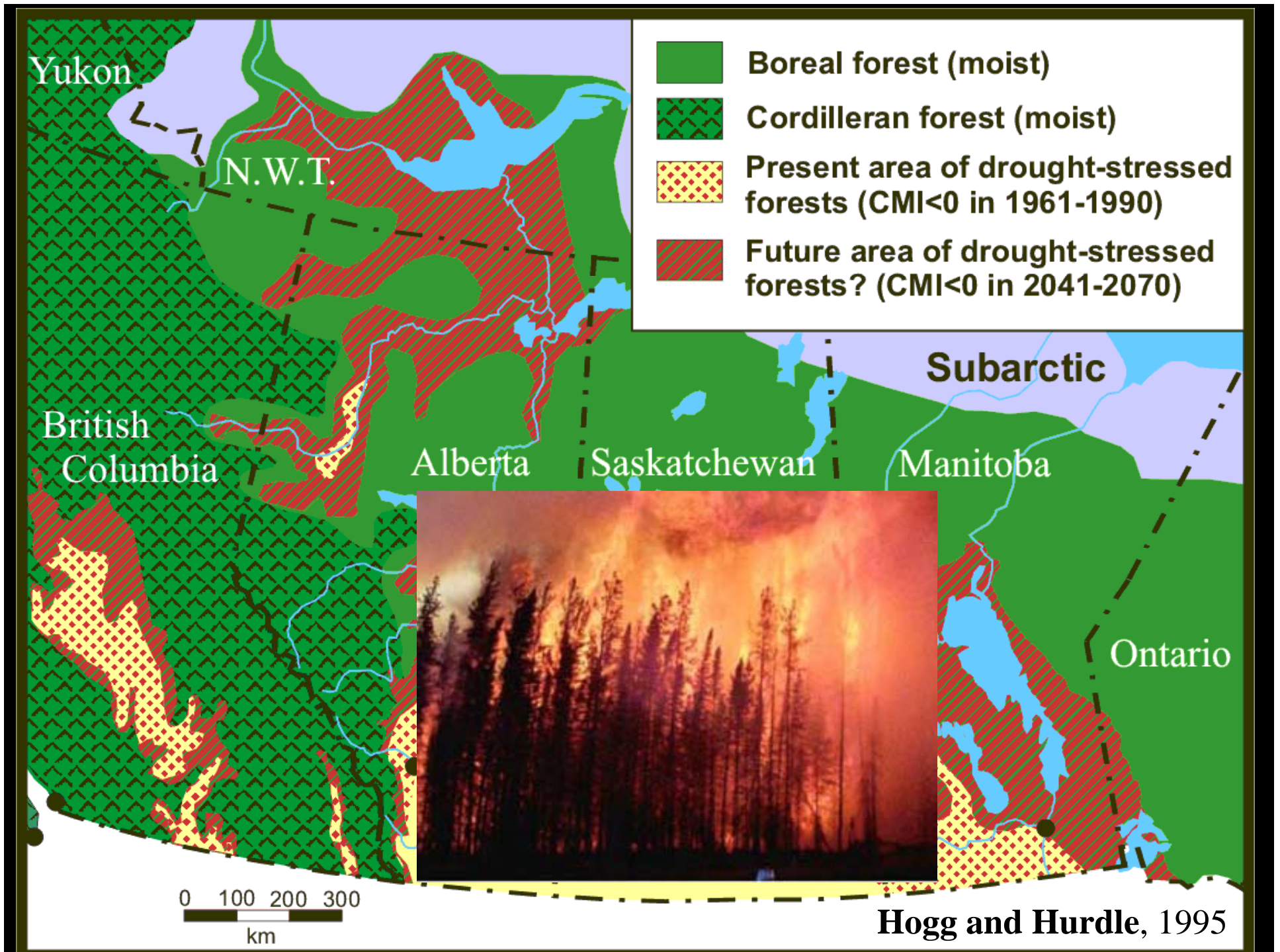
Lake Winnipeg Water Quality



Lake Winnipeg. 26 Sept 2001 at 13:49 CST. AVHRR NDVI image
Colours range from brown = low chlorophyll through yellow to
green = high chlorophyll (Greg McCullough, U of M)

Major ecological changes are expected





There will be greater variation in hydroclimate



Red River, 1997 flood,
south of St. Norbert

<http://gsc.nrcan.gc.ca/floods>

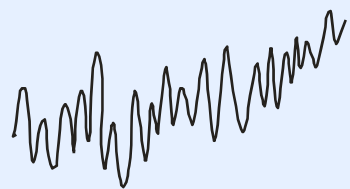
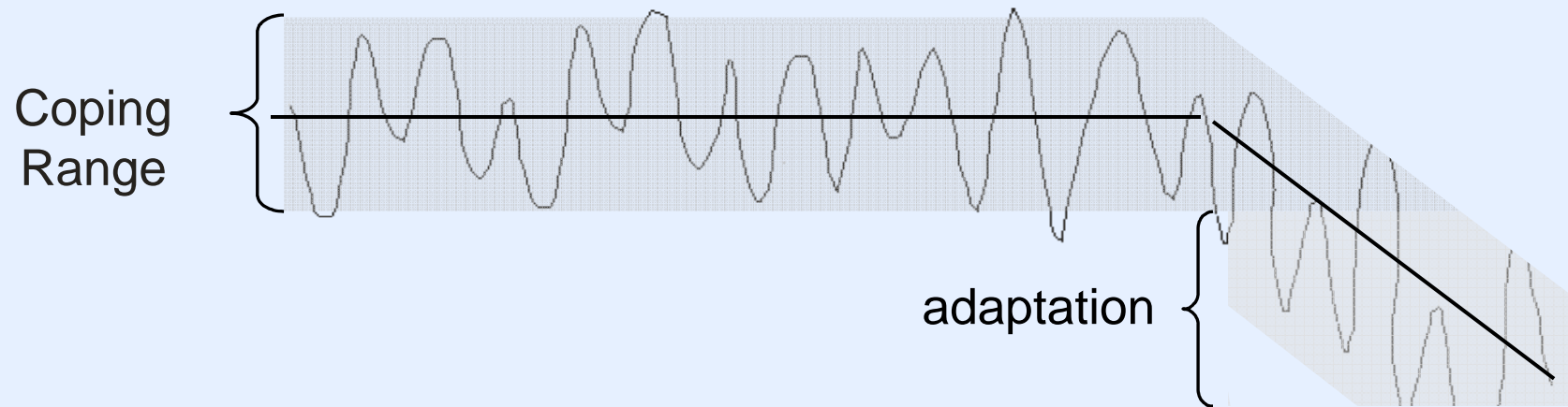
Morris

Both drought and
unusually wet years
could occur with
greater frequency and
severity



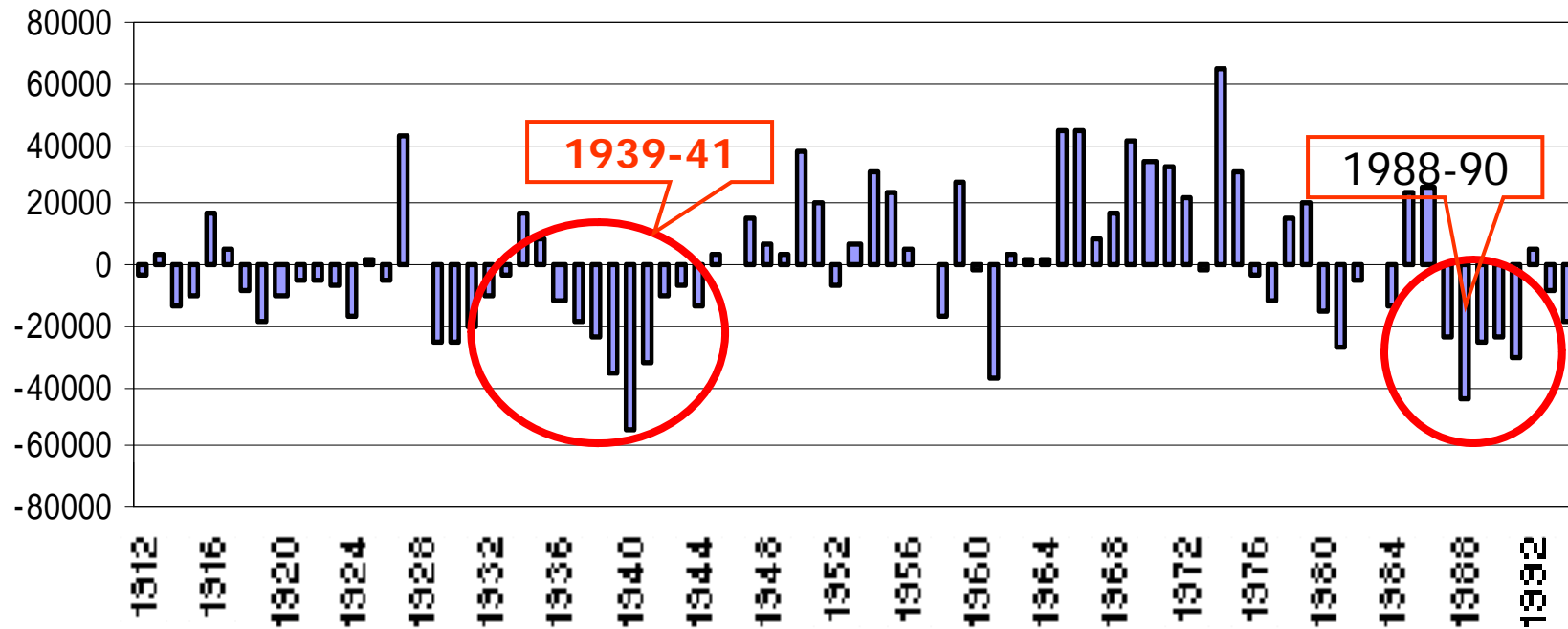
Climate Trends and Variability

———— mean conditions

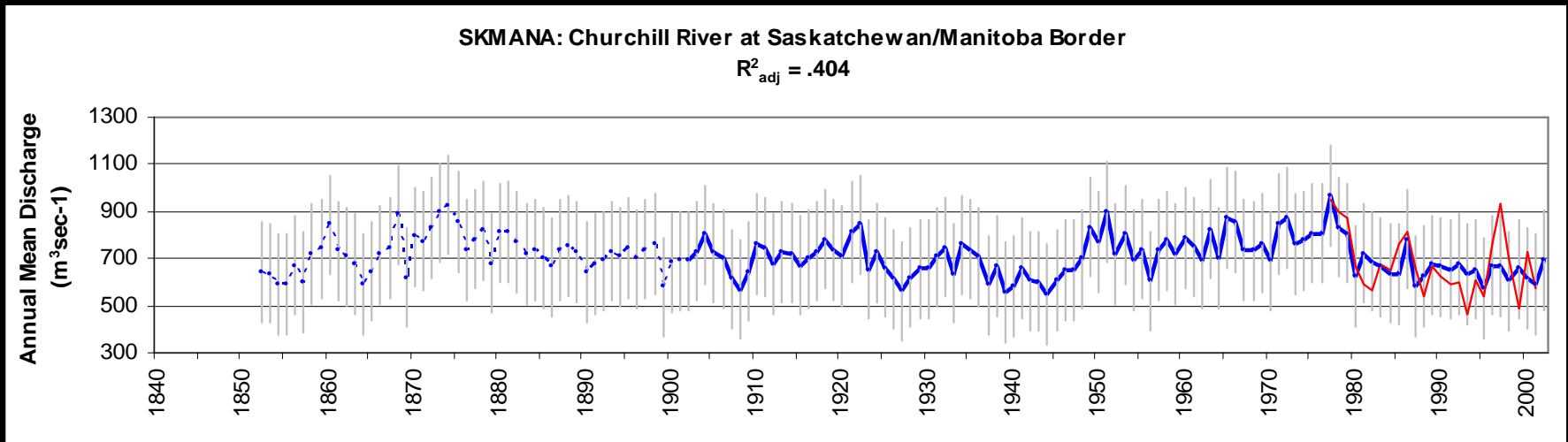
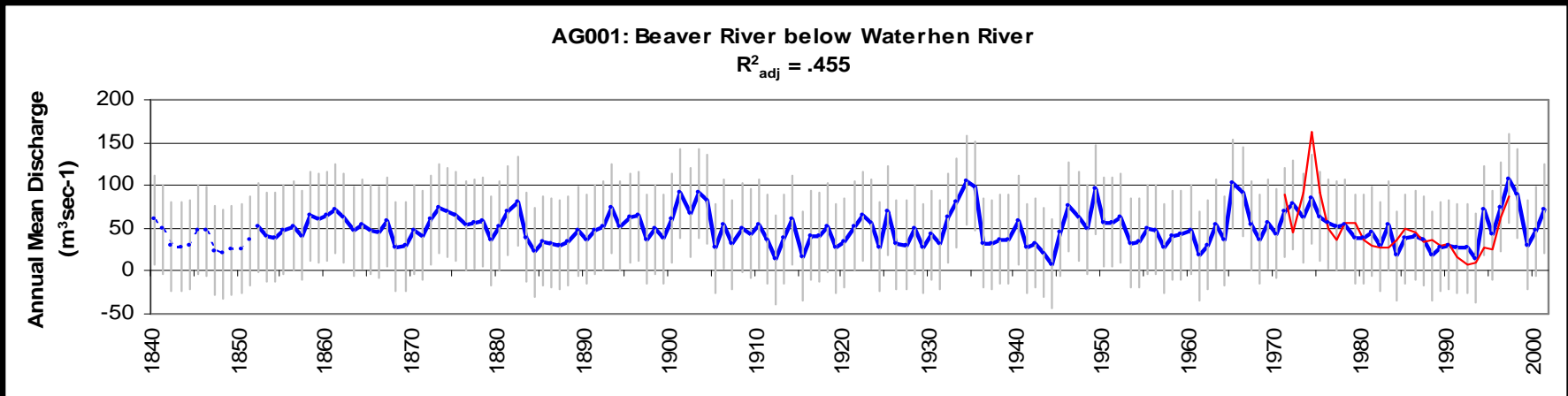


departures from mean conditions

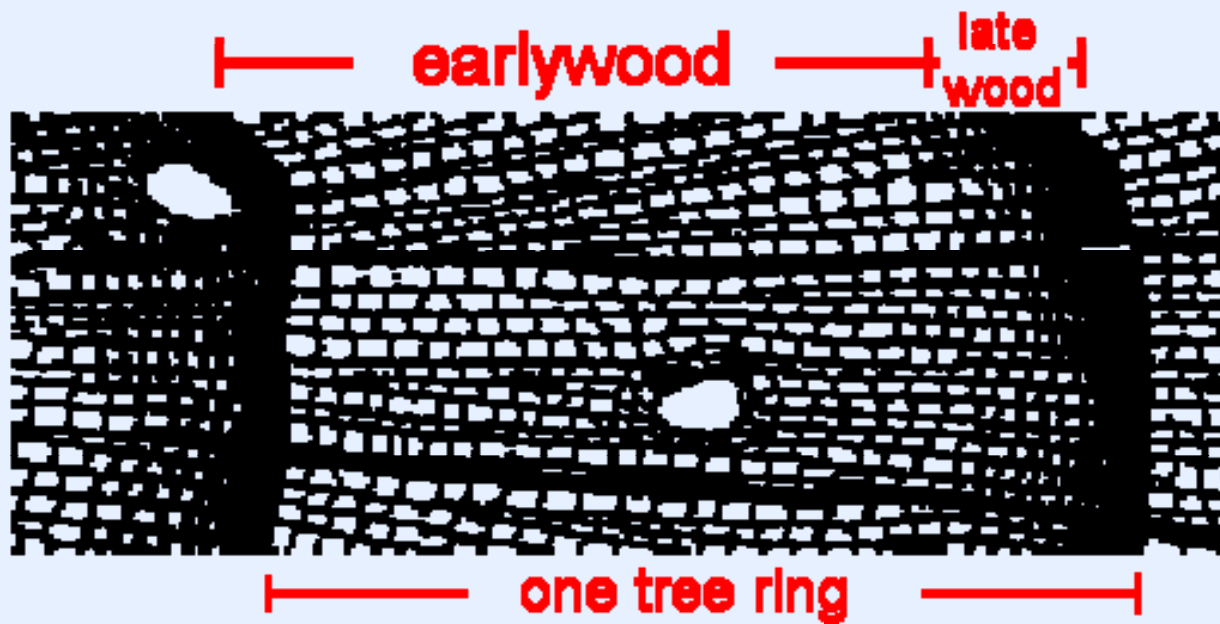
Annual Deviations from mean inflow to Nelson River (cfs)

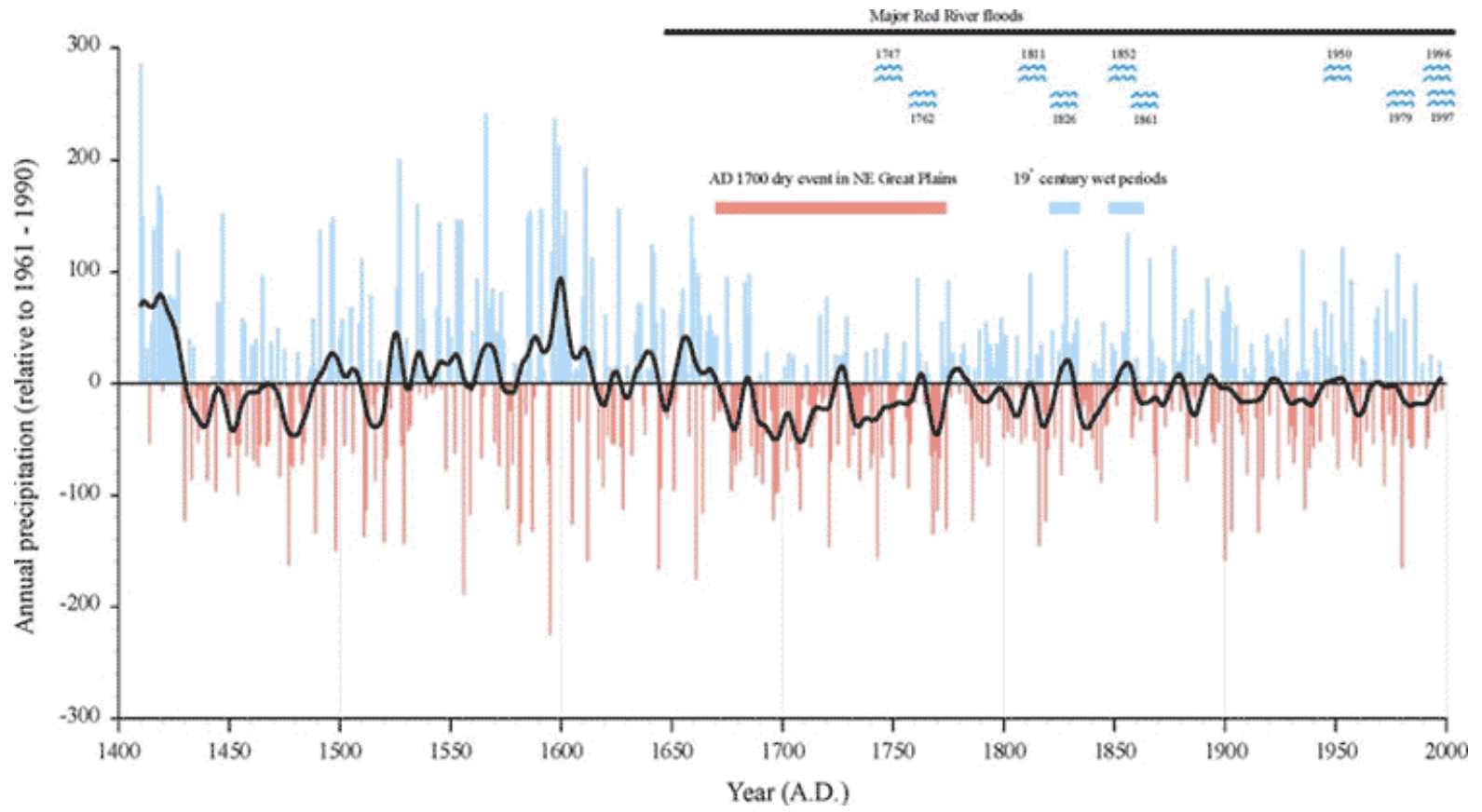


Streamflow Reconstructions, Churchill River Basin



Berault and Sauchyn, CWRJ, 2006





St. George and Nielsen

Most impacts are adverse because most economies and practices are not sufficiently adaptive



Resources and communities are sensitive to climate variability

The net impacts of climate change are not clear because they depend on rates of climate change and adaptation strategies



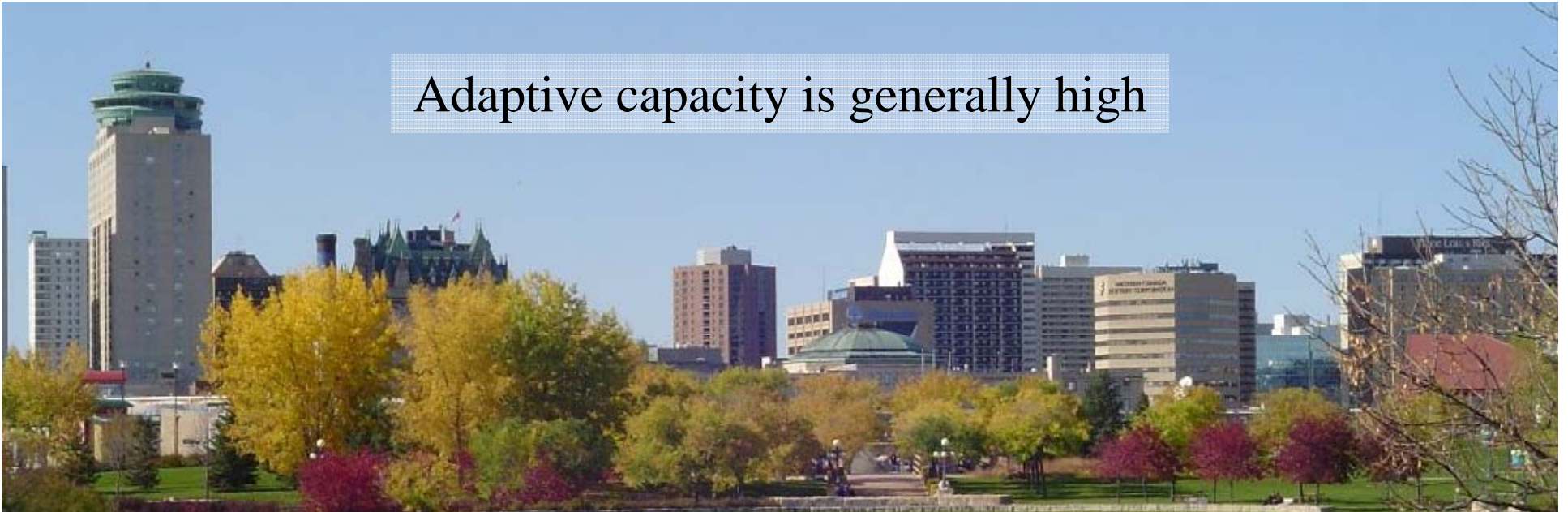
The impacts of climate change will depend on how well we adapt and how much adaptation is required



Adaptive Capacity

Determinant	Explanation
Economic resources	Greater economic resources increase adaptive capacity Lack of financial resources limits adaptation options
Technology	Lack of technology limits range of potential adaptation options Less technologically advanced regions are less likely to develop and/or implement technological adaptations
Information and skills	Lack of informed, skilled and trained personnel reduces adaptive capacity Greater access to information increases likelihood of timely and appropriate adaptation
Infrastructure	Greater variety of infrastructure can enhance adaptive capacity, since it provides more options Characteristics and location of infrastructure also affect adaptive capacity
Institutions	Well-developed social institutions help to reduce impacts of climate-related risks, and therefore increase adaptive capacity
Equity	Equitable distribution of resources increases adaptive capacity Both availability of, and access to, resources is important

Adaptive capacity is generally high



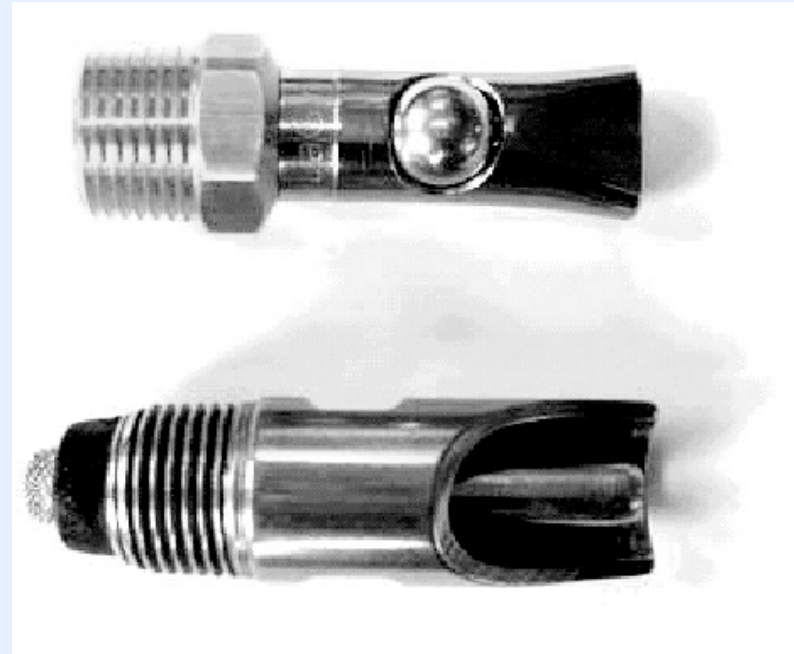
But unevenly distributed



JV Farms, High River, Alberta

ball-bite drinker

standard drinker



- one-year trial, from August 2004 to July 2005, the ball-bite drinker sections of the barn used 35 per cent less water than the standard drinker sections
- no detrimental effects on the animals or facility management
- decrease in water usage led to many secondary benefits

Planned adaptation is a component of adaptive management and sustainable economic development



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Sustainable Agriculture

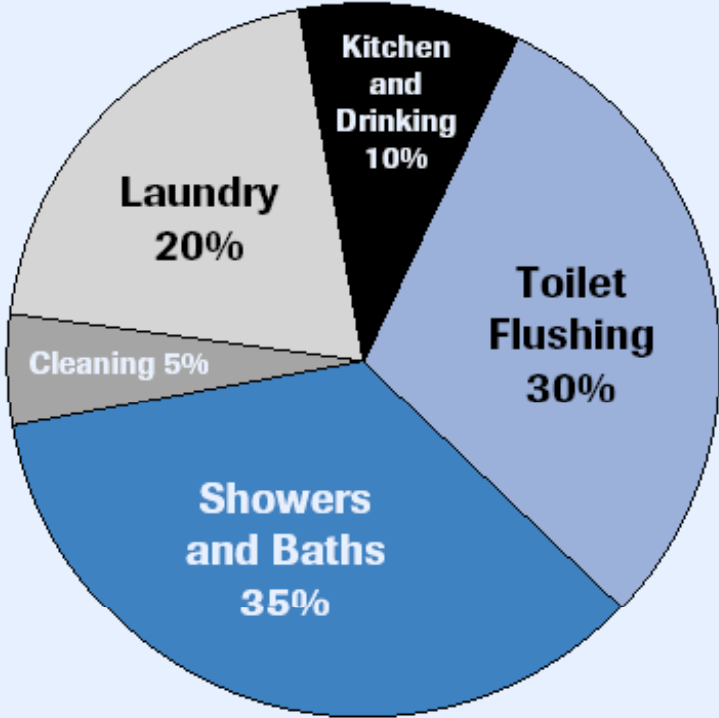
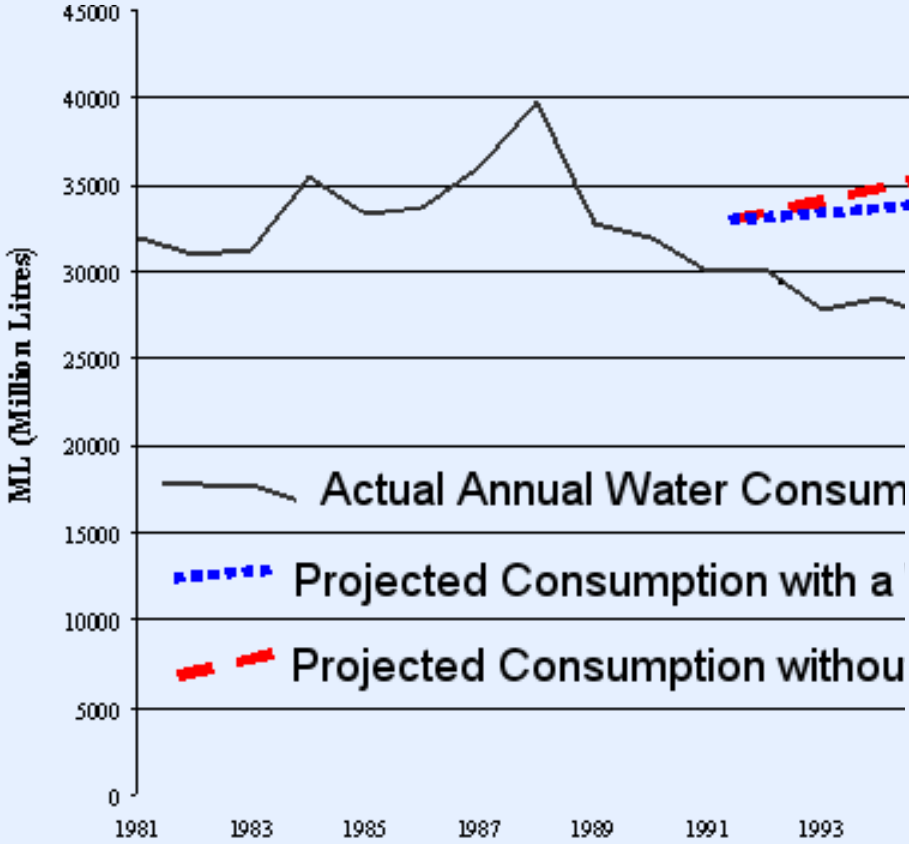
Centre for Young Farmers and
Sustainable Agriculture

Sustainable agriculture refers to an agricultural production and distribution system that:

- Achieves the **integration** of natural biological cycles and controls,
- Protects and renews **soil** fertility and the natural resource base,
- Optimizes the **management and use of on-farm** resources,
- **Reduces** the use of nonrenewable resources and purchased production inputs,
- Provides an adequate and dependable farm **income**,
- Promotes **opportunity** in family farming and farm communities, and
- **Minimizes** adverse impacts on health, safety, wildlife, water quality and the environment

City of Regina Water Consumption

(Ken Wiens, P.Eng., May, 2007)



Institutional / Structural Adaptation: Red River Floodway



<http://gsc.nrcan.gc.ca/floods>



Manitoba Floodway Authority

